In the Claims

This listing of claims will replace all prior versions, and listings, of claims.

Listing of Claims

1. (Original) A method of path gain estimation for a downlink WCDMA (Wideband Code Division Multiple Access) system, the method comprising the following steps:

encoding CPICH (Common Pilot Channel) symbols into a first pilot symbol sequence and a second pilot symbol sequence;

transmitting the first and the second pilot symbol sequence by a first antenna and a second antenna respectively;

receiving signals by a third antenna of a receiver;

decoding and despreading the received signals into received CPICH symbols; and

determining the path gain by a STTD filter coefficient determination process comprising a block selection process for selecting a combination of the received CPICH symbols and a tap gain determination process for determining weighted values for the received CPICH symbols.

2. (Original) The method of path gain estimation as claimed in claim 1, wherein the block selection process further comprises:

obtaining simultaneous equations by choosing four symbol sets ($s0_a$, $s1_a$; $s0_{a+b}$, $s1_{a+b}$; $s0_{a+2b}$, $s1_{a+2b}$; $s0_{a+3b}$, $s1_{a+3b}$) corresponding to the received CPICH symbols (r_a, r_{a+b}, r_{a+2b}, r_{a+3b});

wherein $s0_0$, $s0_1$, $s0_2$, ... represent the first pilot symbol sequence transmitted by the first antenna, $s1_0$, $s1_1$, $s1_2$, ... represent the second pilot symbol sequence transmitted by the second antenna, (a, a+b, a+2b, a+3b) represent timing indices of the symbols, and the timing indices are selected to obtain orthogonal weighted values for the simultaneous equations.

3. (Original) The method of path gain estimation as claimed in claim 2, wherein the simultaneous equations of the block selection process are:

$r_a = s0_a \times (h0-3\Delta 0)+s1_a \times (h1-3\Delta 1)$

$= s0_a \times h0-3s0_a \times \Delta 0+s1_a \times h1-3s1_a \times \Delta 1$

$r_{a+b} = s0_{a+b} \times (h0-\Delta 0)+s1_{a+b} \times (h1-\Delta 1)$

$= s0_{a+b} \times h0-s0_{a+b} \times \Delta 0+s1_{a+b} \times h1-s1_{a+b} \times \Delta 1$

$r_{a+2b} = s0_{a+2b} \times (h0+\Delta 0)+s1_{a+2b} \times (h1+\Delta 1)$

$= s0_{a+2b} \times h0+s0_{a+2b} \times \Delta 0+s1_{a+2b} \times h1+s1_{a+2b} \times \Delta 1$

$r_{a+3b} = s0_{a+3b} \times (h0+3\Delta 0)+s1_{a+3b} \times (h1+3\Delta 1)$

$= s0_{a+3b} \times h0+3s0_{a+3b} \times \Delta 0+s1_{a+3b} \times h1+3s1_{a+3b} \times \Delta 1$

wherein h0, h1, $\Delta 0$, $\Delta 1$ are the weighted values, (h0, h1) represent average transmitted path gains of the first and the second antennas respectively, and ($2\Delta 0$, $2\Delta 1$) represent increments of the path gains after a time spacing b.

4. (Original) The method of path gain estimation as claimed in claim 3, wherein the tap gain determination process comprises solving the simultaneous

equations and estimating path gains of the first and the second antennas according to the average transmitted path gains and the increments of the path gains.

5. (Original) The method of path gain estimation as claimed in claim 4, wherein the tag gain determination process further comprises maintaining a constant sum of the weighted values for the received CPICH symbols.

6. (Original) The method of path gain estimation as claimed in claim 5, wherein the tap gain determination process further comprises assigning a simple constant or an integer to each weighted value for reducing computational complexity.

7. (Original) The method of path gain estimation as claimed in claim 6, wherein the tap gain determination process further comprises setting the weighted values to compensate the path gain estimation jitter caused by carrier frequency offsets.

8. (Original) A system of path gain estimation for a downlink WCDMA (Wideband Code Division Multiple Access) system comprising:

a transmitting device, comprising:

a STTD encoder for encoding CPICH (Common Pilot Channel) symbols into a first and a second pilot symbol sequences based on the STTD scheme;

a first antenna for transmitting the first pilot symbol sequence; and

a second antenna for transmitting the second pilot symbol sequence;

a receiving device, comprising:

a third antenna for receiving signals; and

an STTD decoder for decoding and despreading the received signals into received CPICH symbols; and

a block selection unit for choosing a combination of the received CPICH symbols; and

a tap gain determination unit for determining weighted values corresponding to the received CPICH symbols.

9. (Original) The system of path gain estimation as claimed in claim 8, wherein the block selection unit obtains simultaneous equations by choosing four symbol sets ($s0_a$, $s1_a$; $s0_{a+b}$, $s1_{a+b}$; $s0_{a+2b}$, $s1_{a+2b}$; $s0_{a+3b}$, $s1_{a+3b}$) corresponding to the received CPICH symbols (r_a, r_{a+b}, r_{a+2b}, r_{a+3b});

wherein $s0_0$, $s0_1$, $s0_2$, ... represent the first pilot symbol sequence transmitted by the first antenna, $s1_0$, $s1_1$, $s1_2$, ... represent the second pilot symbol sequence transmitted by the second antenna, (a, a+b, a+2b, a+3b) represent timing indices of the symbols, and the timing indices are selected to obtain orthogonal weighted values for the simultaneous equations.

10. (Original) The system of path gain estimation as claimed in claim 9, wherein the simultaneous equations of the block selection process are:

$r_a \quad = s0_a\times(h0-3\Delta0)+s1_a\times(h1-3\Delta1)$

$= s0_a\times h0-3s0_a\times\Delta0+s1_a\times h1-3s1_a\times\Delta1$

$r_{a+b} \quad = s0_{a+b}\times(h0-\Delta0)+s1_{a+b}\times(h1-\Delta1)$

$= s0_{a+b} \times h0 - s0_{a+b} \times \Delta 0 + s1_{a+b} \times h1 - s1_{a+b} \times \Delta 1$

$r_{a+2b} = s0_{a+2b} \times (h0 + \Delta 0) + s1_{a+2b} \times (h1 + \Delta 1)$

$= s0_{a+2b} \times h0 + s0_{a+2b} \times \Delta 0 + s1_{a+2b} \times h1 + s1_{a+2b} \times \Delta 1$

$r_{a+3b} = s0_{a+3b} \times (h0 + 3\Delta 0) + s1_{a+3b} \times (h1 + 3\Delta 1)$

$= s0_{a+3b} \times h0 + 3s0_{a+3b} \times \Delta 0 + s1_{a+3b} \times h1 + 3s1_{a+3b} \times \Delta 1$

wherein h0, h1, $\Delta 0$, $\Delta 1$ are the weighted values, (h0, h1) represent average transmitted path gains of the first and the second antennas respectively, and ($2\Delta 0$, $2\Delta 1$) represent increments of the path gains after a time spacing b.

11. (Original) The system of path gain estimation as claimed in claim 10, wherein the tap gain determination unit solves the simultaneous equations and estimates path gains of the first and the second antennas according to the average transmitted path gains and the increments of the path gains.

12. (Original) The system of path gain estimation as claimed in claim 11, wherein the tag gain determination unit maintains sum of the weighted values for the received CPICH symbols to be constant.

13. (Original) The system of path gain estimation as claimed in claim 12, wherein the tap gain determination unit assigns a simple constant or an integer to each weighted value for reducing computational complexity.

14. (Original) The system of path gain estimation as claimed in claim 13, wherein the tap gain determination unit sets the weighted values to compensate the path gain estimation jitter caused by carrier frequency offsets.

15. (Original) An apparatus of path gain estimation for a downlink WCDMA (Wideband Code Division Multiple Access) system, wherein the apparatus comprises:

means for encoding CPICH (Common Pilot Channel) symbols into a first pilot symbol sequence and a second pilot symbol sequence;

means for transmitting the first and the second pilot symbol sequence by a first antenna and a second antenna respectively;

means for receiving signals by a third antenna of a receiver;

means for decoding and despreading the received signals into received CPICH symbols; and

means for determining the path gain which performs a STTD filter coefficient determination process comprising a block selection process for selecting a combination of the received CPICH symbols and a tap gain determination process for determining weighted values for the received CPICH symbols.

16. (Original) The apparatus of path gain estimation as claimed in claim 15, wherein the block selection process performed by the means for determining the path gain further comprises:

obtaining simultaneous equations by choosing four symbol sets ($s0_a$, $s1_a$; $s0_{a+b}$, $s1_{a+b}$; $s0_{a+2b}$, $s1_{a+2b}$; $s0_{a+3b}$, $s1_{a+3b}$) corresponding to the received CPICH symbols (r_a, r_{a+b}, r_{a+2b}, r_{a+3b});

wherein $s0_0$, $s0_1$, $s0_2$, ... represent the first pilot symbol sequence transmitted by the first antenna, $s1_0$, $s1_1$, $s1_2$, ... represent the second pilot symbol sequence transmitted by the second antenna, (a, a+b, a+2b, a+3b) represent timing indices of the symbols, and the timing indices are selected to obtain orthogonal weighted values for the simultaneous equations.

17. (Original) The apparatus of path gain estimation as claimed in claim 16, wherein the simultaneous equations of the block selection process are:

$r_a = s0_a \times (h0-3\Delta 0)+s1_a \times (h1-3\Delta 1)$

$= s0_a \times h0-3s0_a \times \Delta 0+s1_a \times h1-3s1_a \times \Delta 1$

$r_{a+b} = s0_{a+b} \times (h0-\Delta 0)+s1_{a+b} \times (h1-\Delta 1)$

$= s0_{a+b} \times h0-s0_{a+b} \times \Delta 0+s1_{a+b} \times h1-s1_{a+b} \times \Delta 1$

$r_{a+2b} = s0_{a+2b} \times (h0+\Delta 0)+s1_{a+2b} \times (h1+\Delta 1)$

$= s0_{a+2b} \times h0+s0_{a+2b} \times \Delta 0+s1_{a+2b} \times h1+s1_{a+2b} \times \Delta 1$

$r_{a+3b} = s0_{a+3b} \times (h0+3\Delta 0)+s1_{a+3b} \times (h1+3\Delta 1)$

$= s0_{a+3b} \times h0+3s0_{a+3b} \times \Delta 0+s1_{a+3b} \times h1+3s1_{a+3b} \times \Delta 1$

wherein h0, h1, $\Delta 0$, $\Delta 1$ are the weighted values, (h0, h1) represent average transmitted path gains of the first and the second antennas respectively, and ($2\Delta 0$, $2\Delta 1$) represent increments of the path gains after a time spacing b.

18. (Original) The apparatus of path gain estimation as claimed in claim 17, wherein the tap gain determination process performed by the means for determining the path gain comprises solving the simultaneous equations and estimating path gains of the first and the second antennas according to the average transmitted path gains and the increments of the path gains.

19. (Original) The apparatus of path gain estimation as claimed in claim 18, wherein the tag gain determination process performed by the means for determining the path gain further comprises maintaining a constant sum of the weighted values for the received CPICH symbols.

20. (Original) The apparatus of path gain estimation as claimed in claim 19, wherein the tap gain determination process performed by the means for determining the path gain further comprises assigning a simple constant or an integer to each weighted value for reducing computational complexity.

21. (Original) The apparatus of path gain estimation as claimed in claim 20, wherein the tap gain determination process performed by the means for determining the path gain further comprises setting the weighted values to compensate the path gain estimation jitter caused by carrier frequency offsets.